



**DEPARTMENT of AGRICULTURE
and NATURAL RESOURCES**

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**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 8744-3, Dakota Bay**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Agriculture and Natural Resources concerning Water Permit Application No. 8744-3, Dakota Bay, 32926 482nd Avenue, Jefferson SD 57038.

The Chief Engineer is recommending APPROVAL of Application No. 8744-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing domestic water uses and water rights, 3) the proposed use is a beneficial use and 4) it is in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board with the following qualifications:

1. The well approved under Water Permit No. 8744-3 is located near domestic wells and other wells which may obtain water from the same aquifer. Water withdrawals shall be controlled so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.
2. The Permit holder shall report to the Chief Engineer annually the amount of water withdrawn from the Missouri Elk Point aquifer.
3. Water Permit No. 8744-3 authorizes a total diversion of up to 28.6 acre-feet of water the first year when use begins and then up to 7.99 acre-feet annually from the Missouri Elk Point aquifer.

See report on application for additional information.

Eric Gronlund, Chief Engineer
May 18, 2023

Report to the Chief Engineer
On Water Permit Application No. 8744-3

Dakota Bay
c/o Mike Chicoine

May 19, 2023

Water Permit Application No. 8744-3 proposes to appropriate an amount of water not to exceed 28.6 acre-feet the first year of use followed by up to 7.99 acre-feet annually at a maximum instantaneous diversion rate of 1.55 cubic feet per second (cfs) from one existing well (150 feet deep) completed into the Missouri: Elk Point aquifer located in the E ½ SE ¼ (Lot 1 – original survey) of Section 16-T89N-R48W. The existing well is also authorized for irrigation use by Water Permit No. 6557-3 (Water Rights, 2023c). Water from the well will be used for recreational purposes to initially fill a proposed canal (20.61 acre-feet) which connects to McCook Lake and provide up to 7.99 acre-feet annually to cover any evaporation and seepage losses for purposes of preventing the canal liner from drying out, cracking, floating, or otherwise failing. Incidental runoff from adjoining property as well as direct precipitation may also provide water to the canal. The canal project is located in the NW ¼ SW ¼ (Lot 3 – original survey), SW ¼ SW ¼ of Section 15; E ½ SE ¼ (Lot 1 – original survey) of Section 16; all in T89N-R48W on the southeast side of McCook Lake in Union County.

AQUIFER: Missouri: Elk Point (M: EP)

HYDROGEOLOGY:

The Missouri: Elk Point aquifer is a glacial outwash deposit consisting of fine sand to very coarse gravel (Niehus, 1997). The Missouri: Elk Point aquifer underlies approximately 219,100 acres in Clay, Union, and Yankton Counties in South Dakota, and the aquifer contains approximately 3,287,100 acre-feet of recoverable water in storage (Hedges et al., 1982). The Missouri: Elk Point aquifer is hydrologically connected to the Big Sioux, Lower Vermillion-Missouri and Lower James-Missouri aquifers, and the Big Sioux, James, Missouri, and Vermillion Rivers (Niehus, 1994; Stephens, 1967).

In Union County, the average saturated thickness of the Missouri: Elk Point aquifer is approximately 84 feet, with a documented maximum aquifer thickness of approximately 146 feet (Niehus, 1997). The Missouri: Elk Point aquifer is generally under confined conditions in the northwestern part of the aquifer and unconfined conditions in the southern part of the aquifer, and the direction of groundwater movement in the aquifer is generally from the northwest to the southeast (Niehus, 1994 and 1997).

A well completion report is on file for the existing well (authorized by Water Permit No. 6557-3) proposed to be used by Water Permit Application No. 8744-3 (Water Rights, 2023c and 2023d). The report lists, “hard clay” from 0 to 8 feet below the ground surface, “sand” from 8 to 34 feet, “clay” from 34 to 55 feet, “gravel” from 55 to 62 feet, “sand” from 62 to 72 feet, “gravel” from 70 to 75 feet, “sand” from 75 to 110 feet, and “med gravel” from 110 to 150 feet (Water Rights,

2023c and 2023d). The well was screened in “med gravel” from 110 to 150 feet below the ground surface and had an approximate static water level of 13 feet below the ground surface at the time of well completion (May 24, 2005) (Water Rights, 2023d). Based on the well completion report on file, the Missouri: Elk Point aquifer is locally confined at the existing well site but unconfined in nearby areas (Water Rights, 2023d).

Figure 1 displays a map of the approximate Missouri: Elk Point aquifer boundary (modified from Hedges et al., 1982) and the location of the existing well proposed to be used by Water Permit Application No. 8744-3 (Water Rights, 2023c and 2023d).

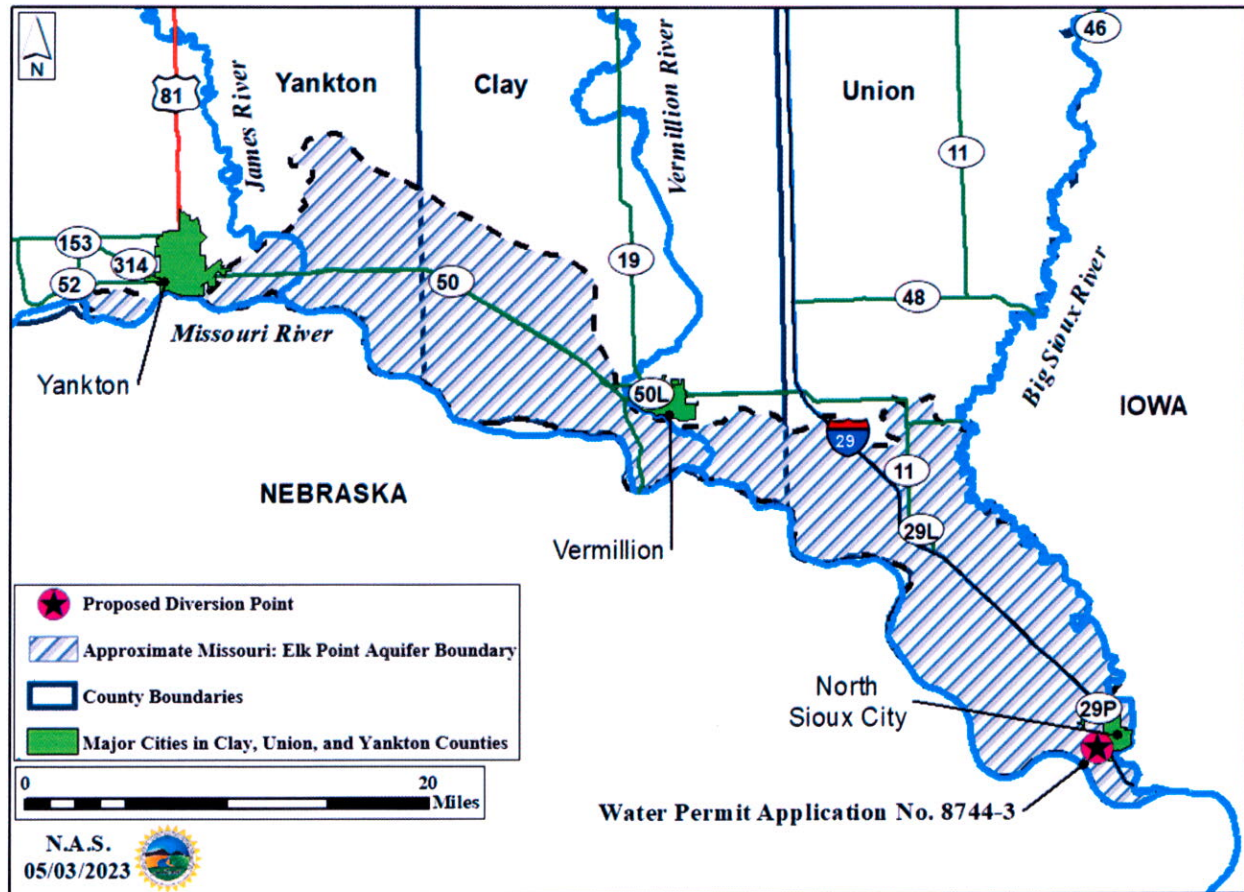


Figure 1. Map of the approximate Missouri: Elk Point aquifer boundary modified from Hedges and others (1982) with the location of the existing well proposed to be used by Water Permit Application No. 8744-3 (Water Rights, 2023c and 2023d)

South Dakota Codified Law (SDCL) 46-2A-9

Pursuant to SDCL 46-2A-9, “A permit to appropriate water may be issued only if there is a reasonable probability that there is unappropriated water available for the applicant’s proposed use, that the diversion point can be developed without unlawful impairment of existing domestic water uses and water rights, and that the proposed use is a beneficial use and in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board as defined by SDCL 46-2-9 and 46-2-11.” This report will address the availability of unappropriated water and the potential for unlawful impairment of existing domestic water uses and water rights within the Missouri: Elk Point aquifer.

WATER AVAILABILITY:

Water Permit Application No. 8744-3 proposes to appropriate water from the Missouri: Elk Point aquifer. The probability of unappropriated water being available from the aquifer can be evaluated by considering SDCL 46-6-3.1, which requires “No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable that the quantity of water withdrawn annually from a groundwater source will exceed the quantity of the average estimated annual recharge of water to the groundwater source. An application may be approved, however, for withdrawals of groundwater from any groundwater formation older than or stratigraphically lower than the greenhorn formation in excess of the average estimated annual recharge for use by water distribution systems.” The Missouri: Elk Point aquifer is not older than or stratigraphically lower than the Greenhorn Formation (Fahrenbach et al., 2010), and the applicant’s proposed use is not for use in a water distribution system as defined by SDCL 46-1-6(17). Therefore, the average annual recharge and average annual withdrawal rates to and from the Missouri: Elk Point aquifer must be considered.

HYDROLOGIC BUDGET:

Recharge

Recharge to the Missouri: Elk Point aquifer is primarily through the infiltration of precipitation where the aquifer is at or near the ground surface, seepage from the Big Sioux, James, Missouri, and Vermillion Rivers, inflow from the Lower Vermillion-Missouri and Lower James-Missouri aquifers at the northern boundary of the Missouri aquifer and inflow from the Big Sioux aquifer at the extreme northeastern boundary of the Missouri aquifer, and from the underlying Dakota aquifer in Union County (Condley and Lamkey, 2022; Niehus, 1994 and 1997).

Several studies have been completed to estimate average annual recharge to the Missouri: Elk Point aquifer (Condley and Lamkey, 2022; Hedges et al., 1985; Mathiowetz, 2022; Stephens, 1967; Stonesifer, 2013). A discussion of these studies is available in the hydrologic budget section within the report for Water Permit No. 8614-3 - Lewis & Clark Regional Water System completed by Mathiowetz (2022). Collectively, the estimated average annual recharge rate to the Missouri: Elk Point aquifer is approximately 114,593.9 acre-feet per year assuming full development of the existing water rights/permits currently held by Lewis & Clark Regional Water System (Mathiowetz, 2022). If Water Permit Application No. 8754-3 (with a priority date

junior to this application), applied for by Lewis & Clark Regional Water System, requesting to appropriate up to 19,121 acre-feet per year, is approved and fully developed, the estimated average annual recharge rate to the Missouri: Elk Point aquifer is approximately 130,770.3 acre-feet per year (Mathiowetz, 2023).

Discharge

Discharge from the Missouri: Elk Point aquifer is primarily through well withdrawals, evapotranspiration where the aquifer is at or near the ground surface, outflow to the Big Sioux and Missouri Rivers during periods of low flow and stage, and leakage to the underlying Dakota aquifer (Niehus, 1994 and 1997; Water Rights, 2023c).

Currently, there are 647 water rights/permits authorized to appropriate water from the Missouri: Elk Point aquifer, plus two pending applications (with priority dates senior to this application) – Water Permit Application No. 8727-3 proposing to irrigate 10 acres of turf at a golf course in Union County, and Water Permit Application No. 8739-3 proposing to crop irrigate 80 acres in Clay County (Water Rights, 2023c). There is one additional pending application (with a priority date junior to this application) - Water Permit Application No. 8754-3, applied for by Lewis & Clark Regional Water System, requesting to appropriate up to 19,121 acre-feet per year (Water Rights, 2023c).

Additionally, there are five future use permits (Nos. 5832-3, 6237-3, 6869-3, 6869A-3, and 7208-3) reserving 1,900 acre-feet of water annually from the Missouri: Elk Point aquifer (Water Rights, 2023c). For the purpose of estimating average annual withdrawals, the future use permits are assumed to be fully developable for a total of 1,900 acre-feet per year.

Table 1 summarizes the 43 non-irrigation water rights/permits (including two irrigation water permits, see paragraph below) authorized to appropriate water from the Missouri: Elk Point aquifer with the estimated annual use for each water right/permit as determined by their limiting diversion rate or annual volume. Historically, average water use by non-irrigation appropriations limited by an instantaneous diversion rate have been assumed to be pumping 60% of full time at the respective permitted diversion rate. Water rights/permits limited by an annual volume are assumed to withdraw their entire respective annual volume limitation. This is a standard method used by the DANR-Water Rights Program for estimating annual withdrawals by non-irrigation appropriations from an aquifer (Water Rights, 2023c). This method is likely an overestimation of withdrawals. Three municipal water rights were identified as being connected to a rural water system and likely maintain their wells for standby purposes (Drinking Water Program, 2023; Water Rights, 2023c); as such, the average annual water use for these water rights has been estimated to be zero acre-feet per year on Table 1.

Water Permit No. 5998-3 is permitted for the irrigation of turf and Water Permit No. 5998A-3 extends the amount of time allowed for water to be put to beneficial use as authorized by Water Permit No. 5998-3 (Water Rights, 2023c). The estimated use for these two irrigation permits is included with the non-irrigation water rights/permits listed on Table 1, as the permit holder is not required to submit an annual irrigation questionnaire. However, Water Permit No. 5998-3 is authorized for use in a rural water system and the permit holder reports the annual use by Water

Permit No. 5998-3 with their other rural water system Missouri: Elk Point aquifer permits, listed on Table 2 (Water Rights, 2023c).

Water Permit No. 7059-3 is permitted for recreational use for maintaining the water level of a small lake with a surface area of 17.6 acres (Water Rights, 2023c). It is assumed that the only consumptive use of this water is due to evaporation; however, it is likely there is some seepage through the bottom of the pond (Water Rights, 2023c). Annual evaporation of water from shallow lakes is estimated to be approximately 42 inches per year at the location of the authorized diversion point for Water Permit No. 7059-3 (NOAA, 1982; Water Rights, 2023c), and average annual total precipitation at the Sioux City, Iowa airport was determined to be approximately 29.27 inches over a 30-year period of record (1991 to 2020) (Arguez et al., 2020), which results in the lake to fluctuate approximately 12.73 inches per year. To maintain the water level of the small lake, the estimated use of Water Permit No. 7059-3 is approximately 18.7 acre-feet per year.

Overall, the average annual withdrawal rate for the 43 non-irrigation water rights/permits (including the two irrigation permits not required to submit an annual irrigation questionnaire) authorized to appropriate water from the Missouri: Elk Point aquifer is approximately 70,648 acre-feet per year (Table 1) (Water Rights, 2023c and 2023f).

Report on Water Permit Application No. 8744-3

Table 1. Estimated annual use for the non-irrigation water rights/permits (plus two irrigation water permits for Clay RWS) authorized to divert water from the Missouri: Elk Point aquifer (Drinking Water Program, 2023; Water Rights, 2023c and 2023f)

Permit No.	Name	Status	Priority Date	Use	Authorized Diversion Rate (cfs)	Authorized Annual Volume (acre-feet/year)	Total Estimated Use (acre-feet/year)
4501-3	Eddie Wohl	LC	03/27/1980	COM	0.05		21.7
5616-3	Cimpls Inc	LC	01/31/1992	COM	0.44		191.2
5827-3	Don Lantis	LC	06/08/1994	COM	0.022		9.6
5953-3	H & K Oil Co	LC	08/19/1996	COM	0.037		16.1
6151-3	Vernon & Norma Vakoc	LC	10/04/1999	COM	0.67		291
6580-3	West Shores Acres LLC	LC	01/28/2005	COM	0.10		43.5
8031-3	Dakota Protein Conversion Inc	PE	06/18/2014	COM	0.22		95.6
8147-3	Doug Lafleur	PE	04/06/2015	COM, LCO	1.0	160	162
8381-3	RP Constructors	PE	11/19/2018	COM	0.04	1	1
8403-3	Stockmen's Livestock Inc	PE	06/27/2019	COM	2.0	40	40
8415-3	3 Sons Properties	PE	11/14/2019	COM	0.10	25	25
8435-3	Sioux City Insulation	PE	07/30/2012	COM	0.33	1	1
6744-3	Judith I Grant	PE	07/24/2006	DOM, COM	0.78		339.0
7388-3	Clay RWS Inc	PE	07/30/2012	DOM, IRR	2.0		346
5998-3	Clay RWS Inc	PE	04/21/1997	IRR, DOM	2.2		
5998A-3	Clay RWS Inc	PE	04/21/1997	IRR, DOM	0.0		
5490-3	USGS CERC Field Research Station	LC	11/15/1990	FWP	0.09		39.1
5907-3	US Fish and Wildlife Service	LC	01/26/1996	FWP	3.78		1,642
6733-3	US Fish and Wildlife Service	LC	06/07/2006	FWP	1.11		482.5
7094-3	US Fish and Wildlife Service	LC	12/01/2008	FWP	2.67		1,159.8
5021-3	Vishay-Dale Electronics Inc	LC	05/04/1984	IND	0.10		43.5
5388-3	LG Everist Inc	LC	01/30/1990	IND	0.45		195.6
5453-3	AaLadin Industries Inc	LC	05/24/1990	IND	0.05		21.7
5593-3	Vishay-Dale Electronics Inc	LC	10/31/1991	IND	0.056		24.3
6170-3	Knife River	LC	01/03/2000	IND	0.222		96.5
1255-3	City of Elk Point	LC	01/01/1914	MUN	1.13		491.1
143-3	City of Vermillion	LC	01/21/1956	MUN	1.78		773.7
147-3	City of Vermillion	LC	01/01/1935	MUN	2.66		1,237
6236-3	City of Vermillion	LC	11/06/2000	MUN	2.6	1,161	
6354-3	City of Vermillion	LC	08/12/2002	MUN	0.022		10
1965-3	Town of Gayville	LC	01/01/1914	MUN	0.37		0*
4207-3	Town of Jefferson	LC	01/01/1916	MUN	0.90		391
5118-3	Town of Gayville	LC	01/28/1987	MUN	0.33		0*
5437-3	Dakota Dunes Community Improvement District	LC	04/12/1990	MUN	3.33		2,412
5782-3	City of North Sioux City	LC	08/12/1993	MUN	1.14		495.5
8212-3	City of Yankton	LC	03/25/2016	MUN	20.12	6,050	6,050
7059-3	WE Investments LLC	PE	08/28/2008	REC	3.11		18.7
6736-3	Lewis and Clark RWS	PE	07/08/1994	RWS	27.85	20,165	53,442
7207-3	Lewis and Clark RWS	PE	07/08/1994	RWS	20	12,000	
8613-3	Lewis and Clark RWS	PE	07/16/2007	WDS	29.8	13,000	
8614-3	Lewis and Clark RWS	PE	03/04/2022	RWS	77.61	8,277	
5581-3	Larson's Landing	LC	07/30/1991	SHD	0.089		38.7
5592-3	East Winds Court Inc	LC	10/09/1991	SHD	0.11		0*
						TOTAL:	70,648
*Identified as being connected to a RWS; therefore, water use from aquifer is presumed to be zero acre-feet/year							
COM: Commerical; DOM: Domestic; FWP: Fish and Wildlife Propagation; IND: Industrial; IRR: Irrigation; LCO: Livestock Confinement Operation;							
MUN: Municipal; REC: Recreation; RWS: Rural Water System; SHD: Suburban Housing Development							

Of the 43 non-irrigation water rights/permits (including the two irrigation permits not required to submit an annual irrigation questionnaire), there are 16 non-irrigation water rights/permits that are required to report their annual usage from the Missouri: Elk Point aquifer (Water Rights, 2023c and 2023f).

Four of the non-irrigation water rights/permits that are required to report (Nos. 8031-3, 8415-3, 8435-3, and 8614-3) are currently under development (or were approved in 2023) and have not reported any withdrawals from the Missouri: Elk Point aquifer to the DANR-Water Rights Program (Water Rights, 2023c). The remaining twelve non-irrigation water rights/permits that are required to report their annual usage from the Missouri: Elk Point aquifer are shown on Table 2 (Water Rights, 2023c and 2023f). The reported usage (as shown on Table 2) for Permit Nos. 8381-3 and 8403-3 (approved in 2018 and 2019) is not necessarily reflective of the future usage of these permits based on information within their respective water permit files (Water Rights, 2023c), and only three years of reported withdrawals (Water Rights, 2023f). Therefore, the estimated use for Permit Nos. 8031-3, 8415-3, 8435-3, 8381-3, and 8403-3 will be based on the method used above: water rights/permits limited by an instantaneous diversion rate have been assumed to be pumping 60% of full time at the respective permitted diversion rate; water rights/permits limited by an annual volume are assumed to withdraw their entire respective annual volume limitation. The estimated average annual withdrawal rate for these permits is listed on Table 1.

Next, the reported use for the City of Yankton (8212-3) and Lewis and Clark Regional Water System (6736-3, 7207-3, and 8613-3) (as shown on Table 2) is steadily increasing (Water Rights, 2023f), as these water users are continually undergoing development (8614-3 was approved in 2023) (Water Rights, 2023c). It is likely these water users will use up to their entire respective annual volume limitation in the future; therefore, the average annual withdrawal rate for these water rights/permits is assumed to be their entire respective annual volume listed on Table 1 (Water Rights, 2023c).

The annual withdrawal rate for Clay Rural Water System Inc (Permit Nos. 5998-3, 5998A-3, and 7388-3) averaged over the last ten years (approximately 346 acre-feet per year) is more reflective of current usage than the entire period of record of reported withdrawals because the first few years the permit holder reported values were during a construction period (Water Rights, 2023c and 2023f). The average annual withdrawal rate based off the reported annual withdrawal rates averaged from 2012 to 2021 on Table 2 for these water permits will be used in this analysis.

Lastly, the annual withdrawal rates for Doug Lafleur (8147-3) and City of Vermillion (147-3, 6236-3) on Table 2 are relatively steady over their respective periods of record (Water Rights, 2023c and 2023f); therefore, the average annual withdrawal rate based on the reported values from each of these water users (as shown on Table 2) is reasonably reflective of the future withdrawals likely to be made by these appropriative users. The average annual withdrawal rate based off the reported annual withdrawal rates averaged over the period of record on Table 2 for these water rights/permits will be used in this analysis.

Table 2. Non-irrigation water rights/permits required to report their respective annual use from the Missouri: Elk Point aquifer (Water Rights, 2023c and 2023f)

	RP Constructors	Stockmen's Livestock Inc	Clay RWS Inc	Doug Lafleur	City of Vermillion	City of Yankton	Lewis and Clark RWS
	8381-3	8403-3	5998-3, 5998A-3, 7388-3	8147-3	147-3, 6236-3	8212-3	6736-3, 7207-3, 8613-3
2003			238		1,363		
2004			483		1,226		
2005			21		1,247		
2006			170		1,252		
2007			217		1,344		0
2008			213		1,199		0
2009			215		1,140		0
2010			183		1,071		0
2011			137		1,127		92
2012			525		1,317		3,836
2013			301		1,183		9,368
2014			307		1,121		11,532
2015			278	202	1,161		15,591
2016			231	202	1,175	66	17,091
2017			276	202	1,215	531	18,051
2018			305	98	1,168	504	18,143
2019	0.0171	1	292	135	1,440	1,370	20,397
2020	0.0224	4.2	461	121	1,373	2,923	21,039
2021	0.2332	5.5	486	170	1,378	3,065	23,537
Max	0.2	5.5	525	202	1,440	3,065	23,537
Min	0.0171	1	21	98	1,071	66	0
Avg	0.091	3.57	281	162	1,237	1,410	14,425*
RWS: Rural Water System *Excluded reported zero values							

Currently, there are 606 irrigation water rights/permits authorized to appropriate water from the Missouri: Elk Point aquifer, plus two pending irrigation permit applications collectively proposing to irrigate 90 acres (Water Rights, 2023c). Irrigation water rights/permits have been typically required to report their annual usage on an irrigation questionnaire since 1979. The estimated average annual withdrawal rate for the Missouri: Elk Point aquifer irrigation water rights/permits that have reported over the period of record is approximately 18,703 acre-feet per year (Table 3) (Water Rights, 2023a). To reflect the current development of irrigation water rights/permits more accurately, the average annual withdrawal rate for irrigation appropriations that have reported from 2012 to 2021 is approximately 27,247 acre-feet per year (Table 3) (Water Rights, 2023a).

The usage for two irrigation water permits (Nos. 5998-3 and 5998A-3) was accounted for on Table 1 with the non-irrigation water rights/permits, as the permit holder is not required to submit an annual irrigation questionnaire (Water Rights, 2023c), resulting in only 604 of the Missouri: Elk Point aquifer irrigation water rights/permits being currently required to submit an annual irrigation questionnaire (Water Rights, 2023c).

Additionally, Water Right No. 6110-3 is authorized to divert water from a well completed into the Dakota aquifer and pump the water into two ponds that receive incidental surface runoff and possible groundwater inflow from the Missouri: Elk Point aquifer (Water Rights, 2023c). Water Right No. 6110-3 is included in the 606 irrigation water rights/permits authorized to appropriate water from the Missouri: Elk Point aquifer; however, the estimated use for this permit is assumed to be negligible to the overall hydrologic budget due to the minimal amount of water from the Missouri: Elk Point aquifer the permit holder is expected to withdraw. When omitting Water Right No. 6110-3 and Water Permit Nos. 5998-3 and 5998A-3 from this analysis of Missouri: Elk Point aquifer irrigation water rights/permits, 603 water rights/permits remain.

Table 3 lists only 572 water rights/permits as reporting in 2021 (Water Rights, 2023a and 2023c). These 572 water rights/permits listed as reporting in 2021 includes eight water rights/permits (Nos. 3722-3, 5658A-3, 6940-3, 6941-3, 7066-3, 7447-3, 7663-3, 7800-3, and 7941-3) that were incorporated into another water right or cancelled in 2022 (Water Rights, 2023c), resulting in only 563 of the water rights/permits listed as reporting in 2021 being currently active.

Forty water permits/rights did not submit an irrigation questionnaire form in 2021 that are currently active, accounting for the difference between the 563 currently active water rights/permits listed as reporting in 2021 and the 603 irrigation water rights/permits currently required to submit an annual irrigation questionnaire and annual use being estimated in this analysis (Water Rights, 2023a and 2023c). Of these 40 permits, 37 were issued in 2021, 2022, or 2023 and have not submitted an irrigation questionnaire at this time. Of the remaining three water rights (Nos. 3154-3, 4745-3, and 5935-3), Water Right No. 5935-3 is not required to submit an irrigation questionnaire and Water Right Nos. 3154-3 and 4745-3 did not submit an irrigation questionnaire in 2021 for an unknown reason. Overall, these 37 water permits/rights are authorized to irrigate approximately 3,110 acres (Water Rights, 2023c).

Table 3. Reported historic irrigation use from Missouri: Elk Point aquifer (Water Rights, 2023a)

Year	No. of Permits Reporting	Reported Pumpage (acre-feet)
1979	259	10,258
1980	263	14,937
1981	297	13,931
1982	269	19,143.1
1983	273	11,081
1984	281	9,605.5
1985	282	14,020.7
1986	286	6,324.8
1987	281	13,369
1988	282	28,558.1
1989	292	25,904.3
1990	297	19,508
1991	300	18,877.7
1992	295	1,895
1993	298	1,475.2
1994	295	10,314.9
1995	292	18,761.3
1996	296	9,473.6
1997	305	17,236
1998	313	11,079.5
1999	308	14,877
2000	309	26,551
2001	313	19,115.2
2002	315	23,326.9
2003	314	27,007
2004	322	24,309
2005	335	24,206.1
2006	353	27,943.3
2007	366	30,652
2008	396	16,439
2009	410	6,346
2010	419	2,906.9
2011	431	12,330
2012	445	56,994.7
2013	543	35,090.5
2014	557	12,423.5
2015	563	17,884.1
2016	564	27,869.3
2017	567	37,209.9
2018	570	9,160.7
2019	575	8,736.3
2020	570	26,601
2021	572	40,503.4
Min	259	1,475.2
Max	575	56,994.7
Avg (1979 to 2021)	369	18,703
Avg (2012 to 2021)	553	27,247

Farmer (2018a, 2018b, and 2021) analyzed the amount of water pumped per permitted acre for the period from 1979 to 2005. This period was chosen due to the relatively stable number of permitted acres across the entire period. There was a continual annual increase in the number of permitted acres from 2006 to 2013/2014. Since 2013/2014 the total number of permitted acres has been relatively stable (Mathiowetz, 2022; Water Rights, 2023c). Farmer (2021) determined that it would be best to separate the review of pumpage per permitted acres between crops, such as corn and soybeans, and turf, such as golf courses and lawn irrigation, to describe the pumpage more accurately per permitted acres. Turf irrigation typically requires more water per acre annual than crop irrigation. Mathiowetz (2022) determined over the entire period of record (1979 through 2021), the crop application rate per permitted acre is 0.331 feet per year (3.97 inches per year), and 0.908 feet per year for turf (10.9 inches per year) (Water Rights, 2023a and 2023c).

Currently, there are approximately 83,116.1 acres authorized to be irrigated from the Missouri: Elk Point aquifer (plus two pending irrigation applications – Water Permit App No. 8727-3 proposing to irrigate 10 acres of turf and Water Permit App No. 8739-3 proposing to irrigate 80 acres of crop(s)), with 809.6 of those acres authorized for turf irrigation (Water Rights, 2023c). Table 4 contains the turf irrigation permits with their respective authorized permitted acres and an estimated average annual use based on Mathiowetz’s (2022) application rate per permitted acre (Water Rights, 2023c). By multiplying the application rate of 0.908 feet per acre per year (Mathiowetz, 2022), by the 809.6 acres being turf irrigated (plus 10 acres for pending Water Permit App No. 8727-3) (Water Rights, 2023c), the annual use for turf irrigation yields approximately 744.2 acre-feet per year (Table 4). By multiplying the application rate of 0.331 feet per acre per year (Mathiowetz, 2022), by the 82,386.5 acres (total acres minus turf irrigated acres, including pending Water Permit App No. 8727-3) acres being crop irrigated (Water Rights, 2023c), including 80 acres for pending Water Permit App No. 8739-3, the annual use for crop irrigation yields approximately 27,270 acre-feet per year. Collectively, the average annual use from the Missouri: Elk Point aquifer for both crop and turf irrigation water rights/permits utilizing Mathiowetz’s (2022) application rates is approximately 28,014.1 acre-feet per year.

Table 4. Water rights/permits authorized for irrigation of turf (Water Rights, 2023c)

Permit No.	Name	Status	County	Acres	Total Estimated Use (acre-feet/year)
1294-3	Recreation Development Assn. Inc.	LC	Union	102	92.6
2011-3	TR Golf LLC	LC	Union	95	86.3
5786-3	Dakota Dunes Golf Course	LC	Union	173	157.1
5998-3	Clay Rural Water System Inc	PE	Union	300	272.4
5998A-3	Clay Rural Water System Inc	PE	Union	0	0
5935-3	Ted Waitt	LC	Union	1	0.908
5936-3	Applied Engineering	LC	Yankton	1.8	1.6
8010-3	Ryan Rusher	LC	Yankton	2.5	2.3
8029-3	Dakota Dunes Comm Improvement District	PE	Union	17.8	16.2
8040-3	Heine Electric & Irrigation Inc	LC	Clay	1	0.908
8354-3	TR Golf LLC	PE	Union	30	27.24
8407-3	Gayville-Volin School District 63-1	LC	Yankton	4.5	4.1
8530-3	National Field Archery Association Foundation	LC	Yankton	16	14.5
8560-3	TR Golf LLC	PE	Union	65	59
			TOTAL:	809.6	735.1

There are domestic wells completed into the Missouri: Elk Point aquifer that do not require a water right/permit, so the withdrawal amount from those wells is unknown (Water Rights, 2023d). Due to their relatively low diversion rates, withdrawals from domestic wells are not considered to be a significant portion of the hydrologic budget. Additionally, with the development of rural water systems in areas where the Missouri: Elk Point aquifer is the uppermost aquifer available; it is likely some domestic users may have transitioned to rural water. Therefore, the quantity of water withdrawn by domestic wells is estimated to be negligible to the hydrologic budget for the Missouri: Elk Point aquifer.

Hydrologic Budget Summary

The average annual recharge rate to the Missouri: Elk Point aquifer is approximately 114,593.9 acre-feet per year. The average annual withdrawal rate for the water rights/permits authorized to appropriate water from the Missouri: Elk Point aquifer totals approximately 100,591 acre-feet per year (including the estimated use for Water Permit Application No. 8744-3, if approved) (listed on Table 5). Based on the hydrologic budget, there is a reasonable probability unappropriated water is available from the Missouri: Elk Point aquifer for the proposed appropriation.

Table 5. Estimated use from Missouri: Elk Point aquifer (Water Rights, 2023a, 2023c, and 2023f)

Type of Water Right/Permit	Estimated Use (acre-feet/year)
Future Use Reservations	1,900
Non-Irrigation	70,648
Irrigation (Mathiowetz's (2022) turf and crop application rates) including pending applications: Nos. 8727-3 and 8739-3	28,014
Application No. 8744-3 (if approved, assuming full volume - 20.61 one-time use, 7.99 annually)	28.6
TOTAL:	100,591

OBSERVATION WELL DATA:

Administrative Rule of South Dakota (ARSD) 74:02:05:07 requires that the Water Management Board shall rely upon the record of observation well measurements in addition to other data to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated average annual recharge of the aquifer.

Observation wells provide data on how the aquifer reacts to regional climatic conditions and local pumping. The DANR-Water Rights Program monitors 36 observation wells completed into the Missouri: Elk Point aquifer (Water Rights, 2023b). The five closest observation wells to the well the applicant proposes to use are UN-78C (approximately 0.6 miles southeast), UN-78D (approximately 1.6 miles northeast), UN-77U (approximately 1.8 miles northeast), UN-77V (approximately 1.8 miles northeast), and UN-77Q (approximately 3.8 miles northwest) (as shown in Figure 8) (Water Rights, 2023b). The hydrographs for these observation wells are displayed in Figures 2 to 6 (Water Rights, 2023b). The data points utilized to construct the hydrographs are measurements of the static water level in the observation wells from the top of the well casing. It is worth noting the hydrograph titles display DENR Water Rights Observation Well on the hydrographs when the titles should display DANR Water Rights Observation Well on the hydrographs.

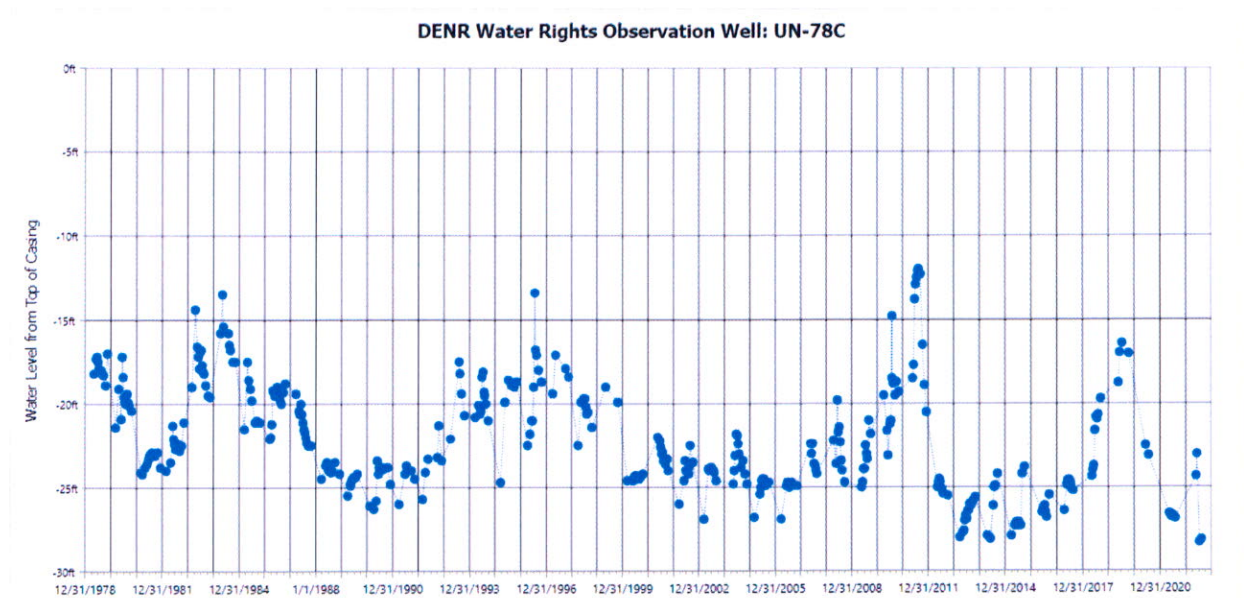


Figure 2. Hydrograph for observation well UN-78C (Water Rights, 2023b)

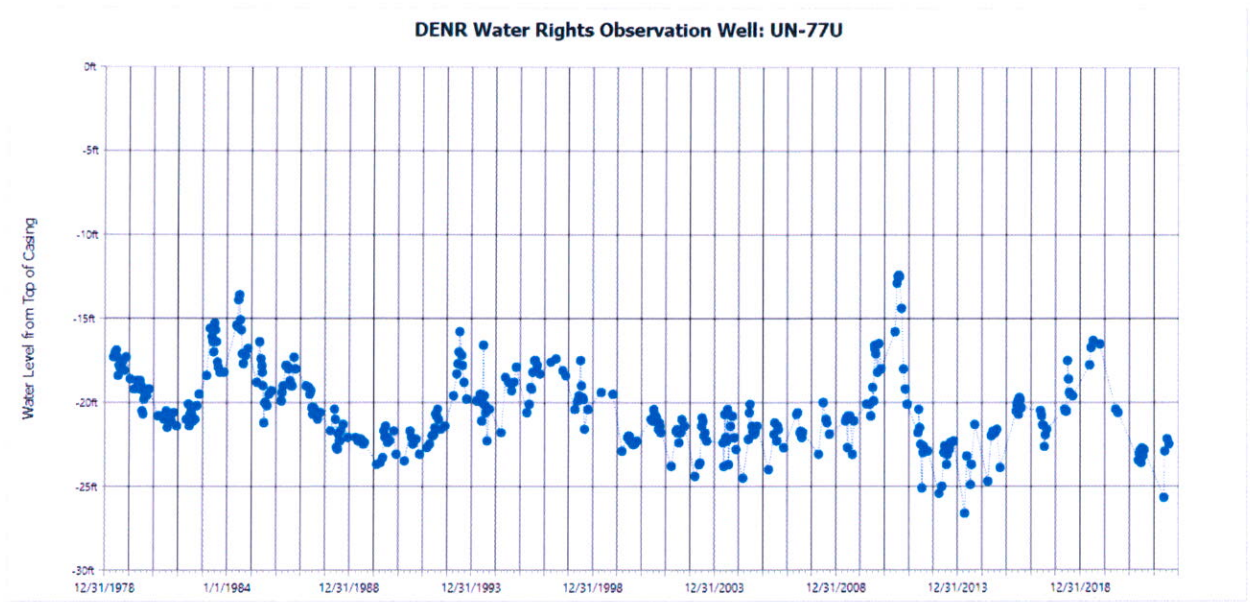


Figure 3. Hydrograph for observation well UN-77U (Water Rights, 2023b)

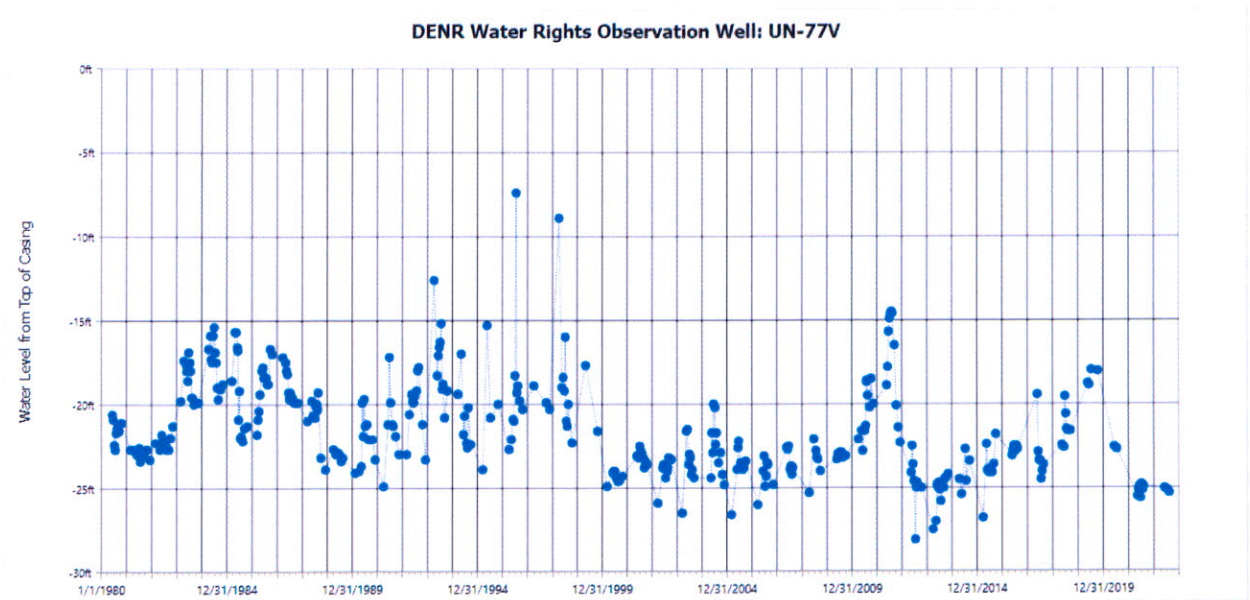


Figure 4. Hydrograph for observation well UN-77V (Water Rights, 2023b)

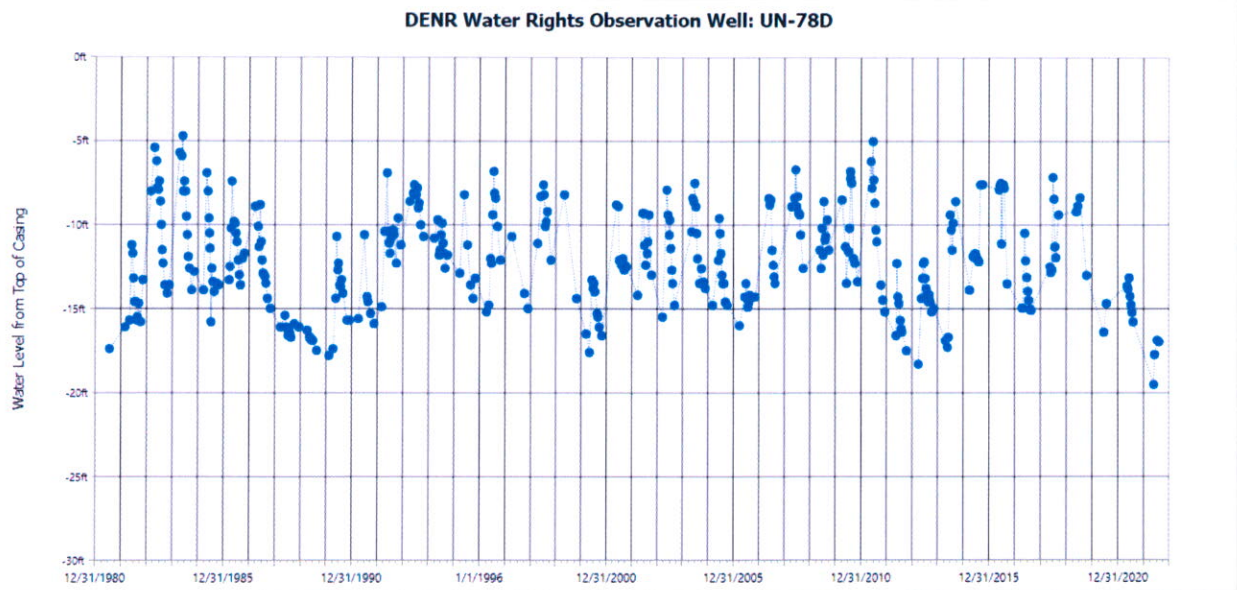


Figure 5. Hydrograph for observation well UN-78D (Water Rights, 2023b)

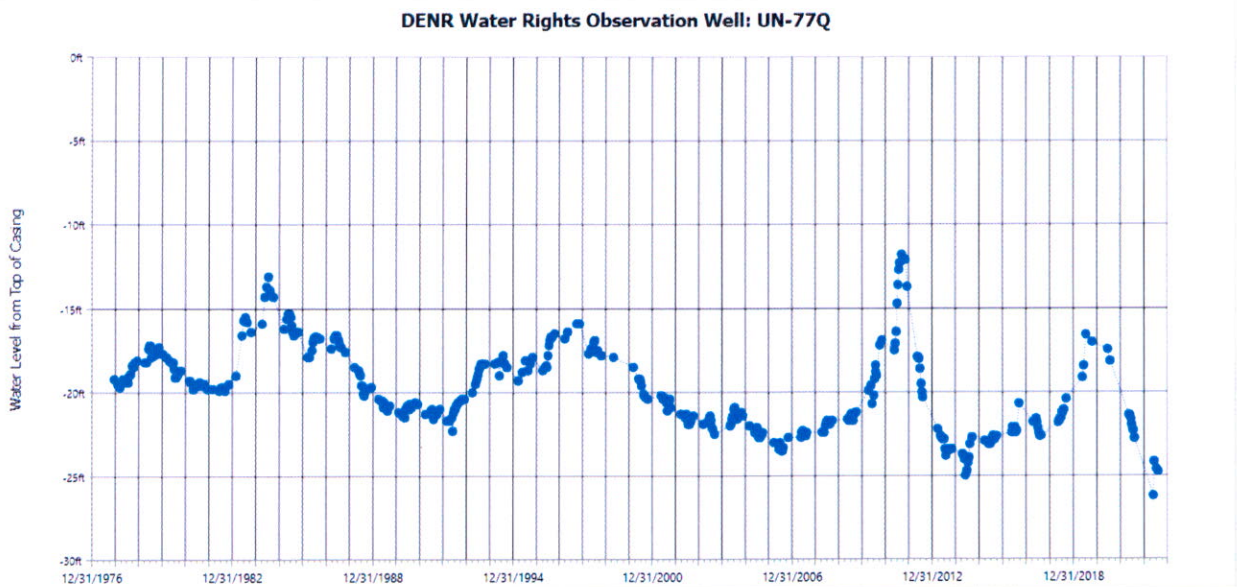


Figure 6. Hydrograph for observation well UN-77Q (Water Rights, 2023b)

The hydrographs for these observation wells were compared to hydrographs for other observations wells completed into the Missouri: Elk Point aquifer and each displayed a generally similar trend as shown on the hydrographs displayed in Figures 2 to 6 (Water Rights, 2023b). Several of the Missouri: Elk Point aquifer observation well hydrographs show a gradual long-term downward trend especially those close to the Missouri River (Water Rights, 2023b). This downward trend is caused by entrenchment of the Missouri River riverbed and in some places a widening of the channel leading to lower water levels despite the river having the same rate of flow (Elliott and Jacobson, 2022). The lowering of the water level in the Missouri River downstream of the Gavin's Point Dam and the subsequent lowering of the water level of

Missouri: Elk Point aquifer observation wells in close proximity to the river show the strong hydrologic connection between the Missouri River and the Missouri: Elk Point aquifer. This is demonstrated by the very similar water levels between the aquifer and river as shown in the hydrographs in Figures 2 to 7. The lowering of the water levels in the aquifer, especially in close proximity to the Missouri River, is not a sign of over appropriation of the Missouri: Elk Point aquifer.

To demonstrate the connection between the aquifer and the Missouri River, consider the United States Geological Survey (USGS) Stream Gage #06467500, located on the Missouri River at Yankton, SD, and the hydrograph for this gage is shown in Figure 7 (USGS, 2023). By comparing the hydrograph for Stream Gage #06467500 to the observation well hydrographs of the Missouri: Elk Point aquifer (Figures 2 to 6), both show the river and aquifer react to climatic conditions by rising and falling over similar trends (USGS, 2023; Water Rights, 2023b). Additionally, during flood events (such as, the years 2011 and 2019), the water level in the Missouri: Elk Point aquifer, especially where in closer proximity to the Missouri River, rises very quickly beyond what is typically seen for glacial outwash aquifers (Water Rights, 2023b). This indicates there is a hydrologic connection between the Missouri: Elk Point aquifer and the Missouri River. Therefore, when the elevation of the water in the Missouri River is higher than the elevation of water in the aquifer, the river will recharge the aquifer. In contrast, when the elevation of water is higher in the Missouri: Elk Point aquifer, the aquifer naturally discharges to the Missouri River. The observation well water levels simply show the connection between the river and the aquifer and how the aquifer reacts to climatic conditions without showing any long-term effects from pumping. Therefore, there is a reasonable probability unappropriated water is available for this proposed appropriation.

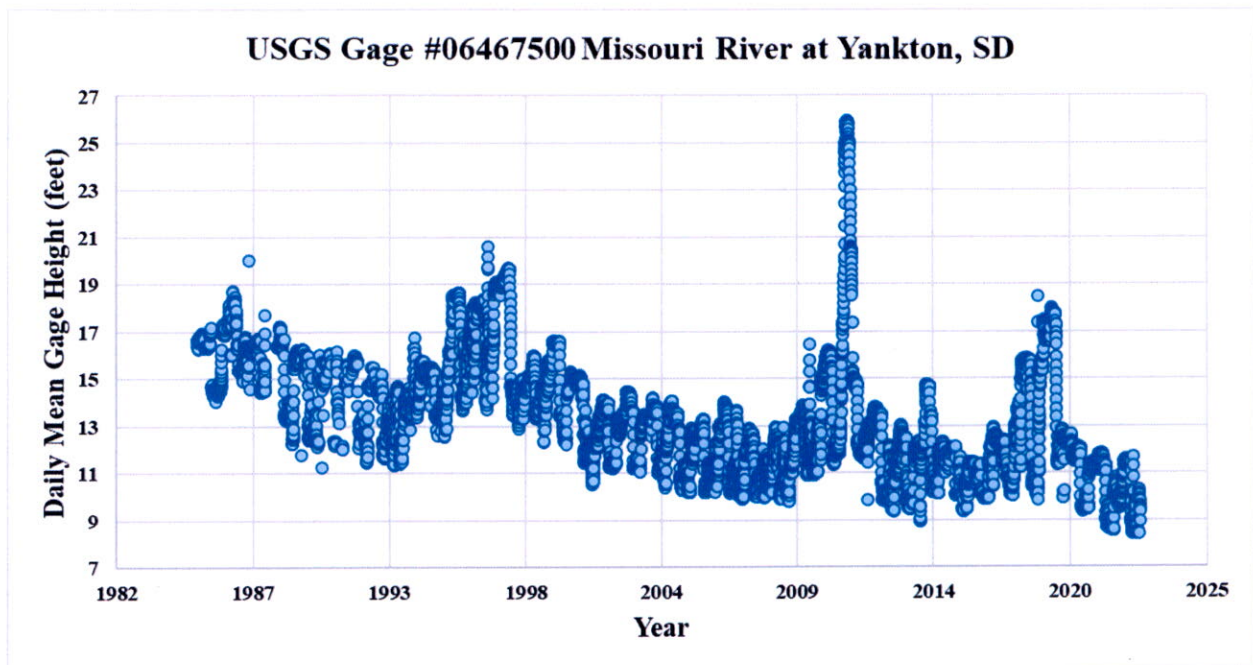


Figure 7. Hydrograph for USGS Stream Gage #06467500 Missouri River at Yankton, SD from 1985 to 2023 (USGS, 2023)

POTENTIAL FOR UNLAWFUL IMPAIRMENT OF EXISTING WATER RIGHTS:

Currently, there are 647 water rights/permits authorized to appropriate water from the Missouri: Elk Point aquifer, plus three pending permit applications (two senior, one junior in priority) (Water Rights, 2023c). The nearest diversion points are authorized by Water Right No. 6680-3 and Water Permit Nos. 8381-3 and 8435-3 and are located approximately one mile southeast and west of the existing well location for this application (Table 6) (Figure 8) (Water Rights, 2023c). These water rights/permits are held by Parks & Wildlife Foundation, RP Constructors, and Sioux City Insulation (Water Rights, 2023c).

There are domestic wells on file with the DNR-Water Rights Program that are completed into the Missouri: Elk Point aquifer, with the closest domestic well on file (not held by the applicant) approximately 0.3 miles northwest of the existing well location (Water Rights, 2023d). There could potentially be other domestic wells completed into the Missouri: Elk Point aquifer near the existing well that are not on file with the DNR-Water Rights Program. The location of the domestic wells is based on the location provided at the time of completion by the well driller.

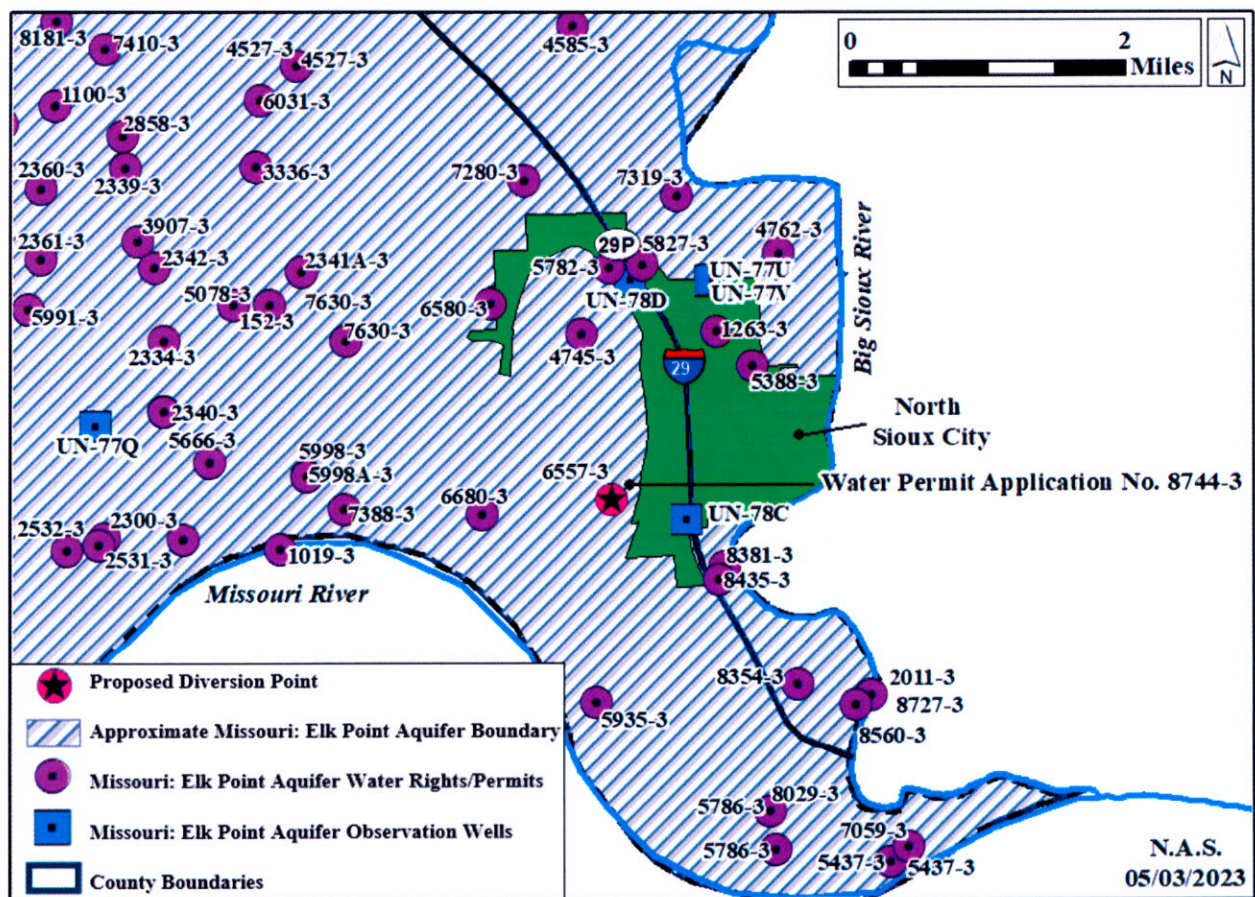


Figure 8. Location of the existing well completed into the Missouri: Elk Point aquifer proposed to be used by Water Permit Application No. 8744-3, with the Missouri: Elk Point aquifer water rights/permits and observation wells within approximately four miles (Water Rights, 2023b and 2023c)

Table 6. Water rights/permits authorized to withdraw water from the Missouri: Elk Point aquifer within approximately four miles of the existing well, as shown in Figure 8 (Water Rights, 2023c)

Permit No.	Name	Status	Use	Authorized Acres if IRR	Authorized Diversion Rate (cfs)	Authorized Annual Volume (acre-feet)
152-3	Stephen F Jones	LC	IRR	39	0.56	
1019-3	Leonard, James, & Richard Dailey	LC	IRR	230	3.27	
1100-3	Vincent Trudeau	LC	IRR	64.5	0.92	
1263-3	Eugene Flynn	LC	IRR	152	2.16	
2011-3	TR Golf LLC	LC	IRR	95	1.31	
2300-3	Michael A Dailey	LC	IRR	125	1.78	
2334-3	Bradley J & Constance J Beavers	LC	IRR	190	2.68	
2339-3	Derochie Farms LLC	LC	IRR	120	1.71	
2340-3	Steve Heitman	LC	IRR	216	2.7	
2341A-3	Alvin J Howe	LC	IRR	216	1.94	
2342-3	Russell Lafleur	LC	IRR	100	1.43	
2360-3	Meryln Karpen	LC	IRR	132	1.9	
2361-3	Meryln Karpen	LC	IRR	132	1.9	
2531-3	Paul E Dailey	LC	IRR	255	2.7	
2532-3	Paul E Dailey	LC	IRR	200	2.7	
2858-3	Alvin J Howe	LC	IRR	136	1.94	
3336-3	LaFleur Farms	LC	IRR	197	2.22	
3907-3	Russell Lafleur	LC	IRR	73	1.04	
4527-3	Booge Properties Limited Partnership	LC	IRR	238	3.4	
4585-3	JFR-INV-LTD, LLC	LC	IRR	167	2.38	
4745-3	McCook Lake Izaak Walton League	LC	IRR	211	3	
4762-3	Mike or Matt Schmitz	LC	IRR	136	1.89	
5078-3	Bradley & Constance Beavers	LC	IRR	40	0.57	
5388-3	L G Everist Inc	LC	IND		0.45	
5437-3	Dakota Dunes Community Improvement District	LC	MUN		3.33	
5666-3	Joe & John Trudeau	LC	IRR	203	1.56	
5782-3	City of North Sioux City	LC	MUN		1.14	
5786-3	Dakota Dunes Golf Course	LC	IRR	173	4.5	
5827-3	Don Lantis	LC	COM		0.022	
5935-3	Ted Waitt	LC	IRR	1	0.044	
5991-3	Donald G Jorgensen	LC	IRR	95	1.36	
5998-3	Clay Rural Water System Inc	PE	IRR	300	2.22	
5998A-3	Clay Rural Water System Inc	PE	IRR		0	
6031-3	LaFleur Farms	LC	IRR	95	1.77	
6557-3	Mike Chicoine	PE	IRR	60	1.55	
6580-3	West Shore Acres LLC	LC	COM		0.1	
6680-3	Parks & Wildlife Foundation	LC	IRR	310	2.44	
7059-3	WE Investments	PE	REC		3.11	
7280-3	Tami Norton-Schrempp	PE	IRR	136	1.78	
7319-3	Matt Schmitz	PE	IRR	120	1.45	
7388-3	Clay Rural Water System Inc	PE	DOM, IRR		2	
7410-3	Eugene Mollet	PE	IRR	67	1.33	
7630-3	Mark A Nylen	PE	IRR	160	3.34	
8029-3	Dakota Dunes Community Improvement District	PE	IRR	17.8	0.78	
8181-3	Marc T Bernard	PE	IRR	40	0.89	
8354-3	TR Golf LLC	PE	IRR	30	1.11	
8381-3	R P Constructors	PE	COM		0.04	1
8435-3	Sioux City Insulation	PE	COM		0.33	1
8560-3	TR Golf LLC	PE	IRR	65	0.12	
8727-3	TR Golf LLC	PE	IRR	10	0	
LC: Licensed Water Right; PE: Water Permit; COM: Commercial; DOM: Domestic; IND: Industrial; IRR: Irrigation;						
MUN: Municipal; REC: Recreation						

The Missouri: Elk Point aquifer ranges from confined to unconfined aquifer conditions, but is primarily under unconfined conditions (Niehus, 1994 and 1997). Based on the well completion report on file for the existing well proposed to be used, the water well completion reports on file for nearby wells completed into the aquifer, and the lithologic logs on file for nearby observation wells, the Missouri: Elk Point aquifer is locally confined at the existing well site but unconfined in nearby areas (SDGS, 2023; Water Rights, 2023b and 2023d). Drawdown created by pumping a well generally does not extend far from the pumped well in an unconfined aquifer; however, in a confined aquifer, drawdown from pumping could extend a distance from the diversion point. The exact drawdown behavior of a well cannot be known without an aquifer performance test. Examination of the hydrographs for observation wells completed into the Missouri: Elk Point aquifer show no signs of being significantly impacted by drawdown caused by pumping, despite usually being located within a mile of several high-yield wells (assumed to be a well with an authorized diversion rate greater than 0.2 cfs) (Water Rights, 2023b and 2023c).

Within one mile of the existing well site, the Missouri: Elk Point aquifer has a saturated thickness of approximately 10 to 60 feet (Water Rights, 2023d). This would generally allow for enough thickness for a pump to be placed 20 feet below the top of the aquifer, which is required for the well to be considered adequate under ARSD 74:02:04:20(6). Any drawdown as a result of the proposed diversion for this application is not expected to unlawfully impair nearby adequate wells. In Clay, Union, and Yankton Counties, there are no substantiated complaints on file with the DANR-Water Rights Program regarding well interference for adequate wells completed into the Missouri: Elk Point aquifer (Water Rights, 2023e).

The Water Management Board recognizes that putting water to beneficial use requires a certain amount of drawdown to occur. The Board has developed rules to allow water to be placed to maximum beneficial use without the necessity of maintaining artesian head pressure for domestic use. The Water Management Board defined an “adversely impacted domestic well” in ARSD 74:02:04:20(7) as:

“A well in which the pump intake was set at least 20 feet below the top of the aquifer at the time of construction or, if the aquifer is less than 20 feet thick, is as near to the bottom of the aquifer as is practical and the water level of the aquifer has declined to a level that the pump will no longer deliver sufficient water for the well owner’s needs.”

The Water Management Board considered the delivery of water by artesian head pressure versus maximum beneficial use during the issuance of Water Right No. 2313-2 for Coca-Cola Bottling Company of the Black Hills. The Board adopted the Findings of Facts and Conclusions of Law that noted the reservation of artesian head pressure for delivery of water would be inconsistent with SDCL 46-1-4 which states, “general welfare requires that the water resources of the state be put to beneficial use to the fullest extent of which they are capable...” (Water Rights, 1995). Furthermore, the Water Management Board found if increased cost or decreased production as a result of impacts on artesian head pressure by legitimate users is to be considered as an unlawful impairment, it would also conflict with SDCL 46-1-4 (Water Rights, 1995). With that in mind, some existing well owners may need to install or lower pumps depending on the specific

characteristics of the Missouri: Elk Point aquifer at their location. However, when considering the statutes (SDCL 46-1-4 and 46-6-6.1), rules (ARSD 74:02:04:20(6) and (7)), the saturated thickness of the Missouri: Elk Point aquifer near the existing well location, the generally unconfined nature of the aquifer, and the lack of well interference complaints from the Missouri: Elk Point aquifer in the area, any drawdown created from the proposed diversion is not expected to cause an unlawful impairment on existing water right/permit holders or domestic users with adequate wells. Therefore, there is a reasonable probability that any interference from the proposed appropriation will not impose unlawful impairments on existing users with adequate wells. Additionally, the existing well proposed to be used has been in place and is presumed to have been in use since roughly 2005 without any reported well interference complaints on file with the DANR-Water Rights Program (Water Rights, 2023d and 2023e).

CONCLUSIONS:

1. Water Permit Application No. 8744-3 proposes to appropriate an amount of water not to exceed 28.6 acre-feet the first year of use followed by up to 7.99 acre-feet annually at a maximum instantaneous diversion rate of 1.55 cfs from one existing well (150 feet deep) completed into the Missouri: Elk Point aquifer. The existing well is also authorized for irrigation use by Water Permit No. 6557-3.
2. Water from the well will be used for recreational purposes to initially fill a proposed canal (20.61 acre-feet) which connects to McCook Lake and provide up to 7.99 acre-feet annually to cover any evaporation and seepage losses for purposes of preventing the canal liner from drying out, cracking, floating, or otherwise failing. Incidental runoff from adjoining property as well as direct precipitation may also provide water to the canal. The canal project is located on the southeast side of McCook Lake in Union County.
3. Based on observation well data and the hydrologic budget, there is a reasonable probability that unappropriated water is available from the Missouri: Elk Point aquifer to supply the proposed appropriation.
4. There is a reasonable probability that the proposed diversion by Water Permit Application No. 8744-3 will not unlawfully impair adequate wells for existing water rights/permits and domestic users.



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Reviewed by:



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